(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 026 445 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
09.08.2000 Bulletin 2000/32

(21) Application number: **99201089.2**

(22) Date of filing: **06.04.1999**

(51) Int Cl.[7]: **F23D 14/36**, F23D 14/02, F23D 14/62, F23D 14/74, F23D 14/58

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **08.02.1999 EP 99200363**

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(54) Gas burner

(57) A gas burner comprising a burner housing (1) having a mounting flange (2) by means of which the gas burner can be mounted on a heating boiler, the burner housing defining at least a part of a channel (K), into which channel a gas supply (6) and a combustion air supply (7) open, the gas burner further comprising a gas supply control valve (8) and a fan (10) for the forced supply of combustion air to the channel, the gas burner further comprising a burner head mounted in/on a downstream end (14) of the channel, said burner head (11) comprising a burner plate (11b) arranged concentrically relative to the longitudinal center line of the channel and at least one burner ring arranged concentrically relative to the burner plate.

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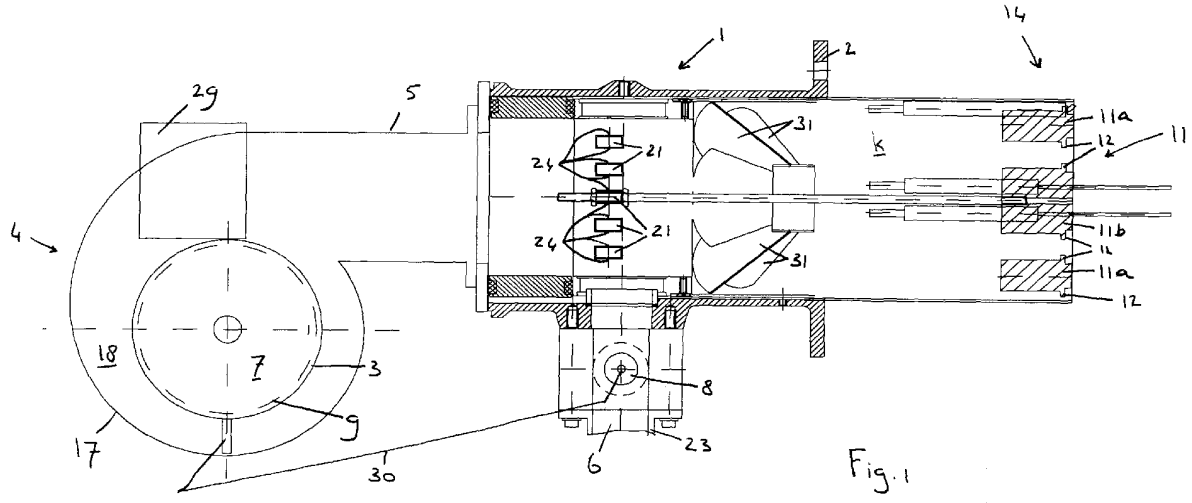

Fig. 1

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Description

[0001] The invention relates to a gas burner comprising a burner housing having a mounting flange by means of which the gas burner can be mounted on a heating boiler, the burner housing defining a channel, into which channel a gas supply and a combustion air supply open, the gas burner further comprising a fan for the forced supply of combustion air to the channel.

[0002] Such a gas burner, also referred to by the term 'externally mounted burner', is known from EP-A-0 612 959. It is a so-called modulable burner, since it cannot only burn on full load, but also on partial load, due to the presence of a gas control valve and an air control valve, if present, or due to the presence of a pneumatic and/or electric gas/air mixture controller. The full-load capacity of the burners is generally within the range of about 100 to 5000 kW. Such gas burners can be mounted on different types of heating boilers which are often produced by different manufacturers. The gas burner are bought by a boiler manufacturer and mounted, by means of the mounting flange, on the boiler produced by the boiler manufacturer. This entails a specific problem, viz. the burners must exhibit a good combustion process, at full load as well as partial load. 'Good combustion process' should be understood to mean a combustion process in which little NO_x (less than 40 mg/m^3 converted to 3% O_2) and CO are produced and which, moreover, proceeds with the least noise production. Another requirement that the heating boiler manufacturers impose on the burner, is that the burner be safe and that the risk of explosions be virtually nil.

[0003] The burners hitherto available do not meet the above requirements and wishes.

[0004] The object of the invention is to provide a gas burner which does meet the above requirements and wishes.

[0005] To this end, according to the invention, the gas burner of the type described in the preamble is characterized by a burner head mounted in/on a downstream end of the channel, which burner head comprises a burner plate arranged concentrically relative to the longitudinal center line of the channel and at least one burner ring arranged concentrically relative to the burner plate.

[0006] Due to the presence of a thus designed burner head, an excellent combustion process is obtained which proceeds without resonance in various types of boilers. This is not only favorable for the combustion, the noise production of the burner is also minimized thereby. By means of the burner head provided with a burner plate and at least one burner ring arranged concentrically relative to the burner plate, a very good, even flame is obtained which, moreover, is properly cooled at the flame root by the burner plate and the burner ring, yielding flue gases having a low NO_x content. A significant advantage of such burner head is further that it can be manufactured in a highly economical manner. The burner head, i.e. the burner plate and the at least one burner ring, may be manufactured from any material that is resistant to a temperature of about 850°C. Preferably, it is a material of low heat conductivity and zero electric conductivity, and that can easily be machined. A relatively cheap material that can be used for this is an insulation material having ceramic fiber.

[0007] In accordance with a further elaboration of the invention, it is particularly favorable if the burner ring and/or the burner plate comprise reduced pressure faces extending perpendicularly to the longitudinal center line of the channel. Such reduced pressure faces provide a post-mixing of the combustion air with the gaseous fuel and moreover contribute to a better flame stability.

[0008] In accordance with a further elaboration of the invention, it is particularly favorable if the gas burner comprises at least one rectangular gas chamber into which the gas supply opens, which gas chamber is arranged downstream of the fan in the channel, while in the or each rectangular chamber there are provided gas supply openings extending substantially in a direction perpendicular to the longitudinal center line of the channel.

[0009] As the gas supply openings extend substantially perpendicularly to the flow direction in the channel, the static pressure on the gas supply openings is so slight, due to the high flow rate of the combustion air along the gas supply openings, that in spite of the low supply gas pressure, the required burner capacity is nevertheless realized. It is thus possible to connect the gas burner to a gas network with a gas pressure of about 20 mbar. Because the gas/air mixture is formed only downstream of the fan, the chance of explosion caused by sparking in the fan is nil. After all, no combustible mixture is present at the fan.

[0010] To promote the mixing even further, in accordance with a further elaboration of the invention, fixed blades may be provided in the channel, downstream of the at least one gas chamber and upstream of the burner head, which blades impart a swirling flow pattern to the gas/air mixture.

[0011] Optionally, in accordance with a further elaboration of the invention, a pressure distributor may be provided in the channel, downstream of the blades and upstream of the burner head. With such a pressure distributor, the rotation in the swirling flow of gas/air mixture is slowed down again, as a result of which the gas pressure is substantially equal over the entire surface area of the burner head, as intended, and not disturbed by the rotation in the flow of gas/air mixture.

[0012] Further elaborations of the invention are described in the subclaims and will be clarified on the basis of an exemplary embodiment, with reference to the accompanying drawings. In these drawings:

Fig. 1 is a sectional view taken on the line I-I in Fig. 2;

Fig. 2 is a front view of the burner shown in section in Fig. 1;

Fig. 3 is a view perpendicular to the main surface of the burner head; and

Fig. 4 is a sectional view taken on the line IV-IV of Fig. 3 of the burner head.

[0013] The exemplary embodiment of a gas burner according to the invention shown in Figs. 1 and 2 comprises a burner housing 1 having a mounting flange 2 by means of which the gas burner can be mounted on a heating boiler. The burner housing 1 defines at least a part of a channel K, into which channel K a gas supply 6 and a combustion air supply 7 open. In this exemplary embodiment, the gas burner further comprises a gas supply control valve 8 and a fan 10 for the forced supply of combustion air to the channel K. Further, the gas burner comprises a burner head 11 mounted in a downstream end 14 of the channel K. The burner head 11 comprises at least one burner ring lla, arranged concentrically relative to the longitudinal center line of the channel K, and a burner plate 11b arranged concentrically relative to the longitudinal center line, which burner plate in the present exemplary embodiment is circular. Downstream of the fan 10, there are provided a number of rectangular gas chambers 21 in the channel K. Each rectangular gas chamber 21 is provided with gas supply openings 24 extending substantially in a direction perpendicular to the longitudinal center line of the channel K. The gas chambers 21 are in fluid connection with the gas supply 6. Upstream of the gas supply openings 24, an air distribution plate (not shown) may be provided in the channel K, which air distribution plate is provided with a number of bores. These bores are preferably arranged in such a manner that the combustion air flows neatly distributed along the rectangular gas chambers 21.

[0014] To obtain an even better mixing, blades 31 are provided in the channel K, downstream of the gas chambers 21 and upstream of the burner head 11. Preferably, the fixedly arranged blades 31 include an angle of 60° with the longitudinal center line of the channel K. The blades 31 impart a rotating flow pattern to the gas/air mixture. To obtain an even pressure distribution over the entire surface area of the burner head 11, there may also be provided a pressure distributor in the channel K, downstream of the blades 31 and upstream of the burner head 11. The pressure distributor may be designed as a number of cylinders of different diameters, arranged concentrically relative to each other and to the longitudinal center line of the channel K.

[0015] As is clearly shown in Figs. 1 and 2, in the present case, the fan 10 is designed as a radial impeller blade wheel 10 driven by a motor 28. The radial impeller blade wheel 10 is arranged in a volute 4 provided with a substantially cylindrical impeller chamber 16 having a substantially cylindrical chamber wall 17 and two facing end walls 18, 19. Connecting to the substantially cylindrical chamber wall 17, at the location of a certain rotational position, is an output pipe 5 extending in tangential direction to the substantially cylindrical chamber wall 17. This output pipe 5 defines the upstream part of the channel K. The end wall 18 is provided with a passage opening 20 located at the level of a rotational center line L of the radial impeller blade wheel 10. At the location of the passage opening 20 in the end wall 18, an input pipe 3 is provided, extending substantially perpendicularly to the relevant end wall 18. The input pipe 3 defines the air supply 7. In the input pipe 3, an air supply control valve 9 is arranged. In the gas supply 6, defined by the gas supply pipe 23, the gas control valve 8, already mentioned, is arranged. Possibly with the interposition of a curve disk, the two control valves 8, 9 are interconnected via a system of rods 30, so that the positions of the air supply control valve 9 and the gas supply control valve 8 are always adjusted to each other. The position of the two valves 8, 9 is controlled by means of a servomotor 29 controlling, for instance, the position of the curve disk. It is observed that the gas supply control valve 8, the air supply control valve 9, the system of rods 30 and the servomotor 29 can be omitted if a pneumatic or electric gas/air mixture control is utilized.

[0016] As mentioned hereinabove, a burner head 11 is provided at the downstream end 14 of the channel K. The burner head 11 comprises a burner plate 11b and at least one burner ring lla which are each provided with reduced pressure faces 12 at an outer and, in so far present, an inner circumferential edge thereof. Preferably, the burner head 11 is manufactured from readily processable material that is resistant to a temperature of at least about 850°C and that is of low heat conductivity and zero electric conductivity. A material meeting these properties is, for instance, ceramic material. In the present exemplary embodiment, a material is used which is presently commercially available as insulation material provided with ceramic fiber.

[0017] The reduced pressure faces 12 in fact serve as stop shoulder for the gas/air mixture flowing past. When the gas/air mixture touches the reduced pressure faces 12, it is caused to swirl. In addition, at the location of the reduced pressure faces 12, the gas/air mixture acquires a higher flow rate. This rate drops immediately after the reduced pressure faces 12 have been passed. After that, the gas/air mixture stabilizes on the downstream side of the reduced pressure faces 12 of the at least one burner ring 11a and the burner plate 11b. Due to this stabilization, a highly stable flame is obtained without this flame being "blown off". The reduced pressure faces 12 also effect a certain after-mixing of the gas/air mixture, to produce a very low NO_x emission. It is necessary that the open passage between the burner ring(s) and the burner plate be chosen correctly, so that the flow rate of the gas/air mixture is under all conditions greater than the combustion rate of the gas used, to prevent flame flashback. Hence, the open passage, i.e. the available flow-through area, can vary with the gas used.

A higher combustion rate of the gas used requires a smaller open passage. The flow resistance of a thus designed burner head 11 is such that a fan 10 of conventional capacity can be employed.

[0018] It is further observed that in the present exemplary embodiment, the channel K is bounded by different parts. For instance, the burner housing 1 comprises a swivel flange 26. Due to the presence of this swivel flange 26, the fan 10 with the volute 4 can be folded away, allowing a maintenance mechanic access to the interior of the channel K, for cleaning or otherwise servicing or replacing the gas chambers 21, the blades 31, the air distribution plate 13, if any, and the inside of the burner head 11.

[0019] It is understood that the invention is not limited to the exemplary embodiment described, but that various modifications are possible within the framework of the invention.

Claims

1. A gas burner comprising a burner housing (1) having a mounting flange (2) by means of which the gas burner can be mounted on a heating boiler, the burner housing (1) defining at least a part of a channel (K), into which channel (K) a gas supply (6) and a combustion air supply (7) open, the gas burner further comprising a fan (10) for the forced supply of combustion air to the channel (K), **characterized by** a burner head (11) mounted in/on a downstream end (14) of the channel (K), said burner head (11) comprising a burner plate (11b) arranged concentrically relative to the longitudinal center line of the channel (K) and at least one burner ring (11a) arranged concentrically relative to the burner plate (11b).

2. A gas burner according to claim 1, characterized in that the burner ring (lla) and/or the burner plate (11b) comprise reduced pressure faces (12) extending perpendicularly to a longitudinal center line of the channel (K).

3. A gas burner according to claim 1 or 2, characterized by at least one rectangular gas chamber (21) into which the gas supply (6) opens, said gas chamber (21) being arranged downstream of the fan (10) in the channel (K), gas supply openings (24) being provided in the or each rectangular gas chamber (21) which extend substantially in a direction perpendicular to the longitudinal center line of the channel (K).

4. A gas burner according to claim 3, characterized in that upstream of the gas supply openings (24) in the channel (K) an air distribution plate (13) is arranged, provided with a number of bores provided in such a manner that the combustion air passes the gas supply openings (24) with proper distribution in the channel (K).

5. A gas burner according to claim 3 or 4, characterized in that downstream of the at least one gas chamber (21) and upstream of the burner head (11), blades (31) are provided in the channel (K) which impart a rotating flow pattern to the gas/air mixture.

6. A gas burner according to claim 5, characterized in that downstream of the blades (31) and upstream of the burner head (11), a pressure distributor is provided in the channel (K).

7. A gas burner according to claim 6, characterized in that the pressure distributor is designed as a number of cylinders of different diameters, arranged concentrically relative to each other and to the longitudinal center line of the channel (K).

8. A gas burner according to any one of the preceding claims, characterized in that the burner head (11) is manufactured from a readily processable material which is resistant to a temperature of at least about 850°C and which is of low heat conductivity and of zero electric conductivity.

9. A gas burner according to any one of the preceding claims, characterized in that the burner head (11) is manufactured from ceramic material.

10. A gas burner according to claim 8, characterized in that the burner head (11) is manufactured from insulation material having a ceramic fiber.

11. A gas burner according to any one of the preceding claims, characterized in that the fan (10) is provided with a radial impeller blade wheel (10) arranged in a volute (4), said volute (4) comprising a substantially cylindrical impeller chamber (16) having a substantially cylindrical chamber wall (17) and two facing end walls (18, 19), while to the substantially cylindrical chamber wall (17), at the location of a certain rotational position, an output pipe (5) connects, extending in tangential direction to the substantially cylindrical chamber wall (17) and bounding a part of the channel, one of the facing end walls (18, 19) being provided with a passage opening (20) located at the level of a rotational center line (L) of the radial impeller blade wheel (10), an input pipe (3) being provided at the location of the passage opening (20) in the end wall (18), said input pipe (3) extending substantially perpendicularly to the relevant end wall (18) and defining the combustion air supply (7).

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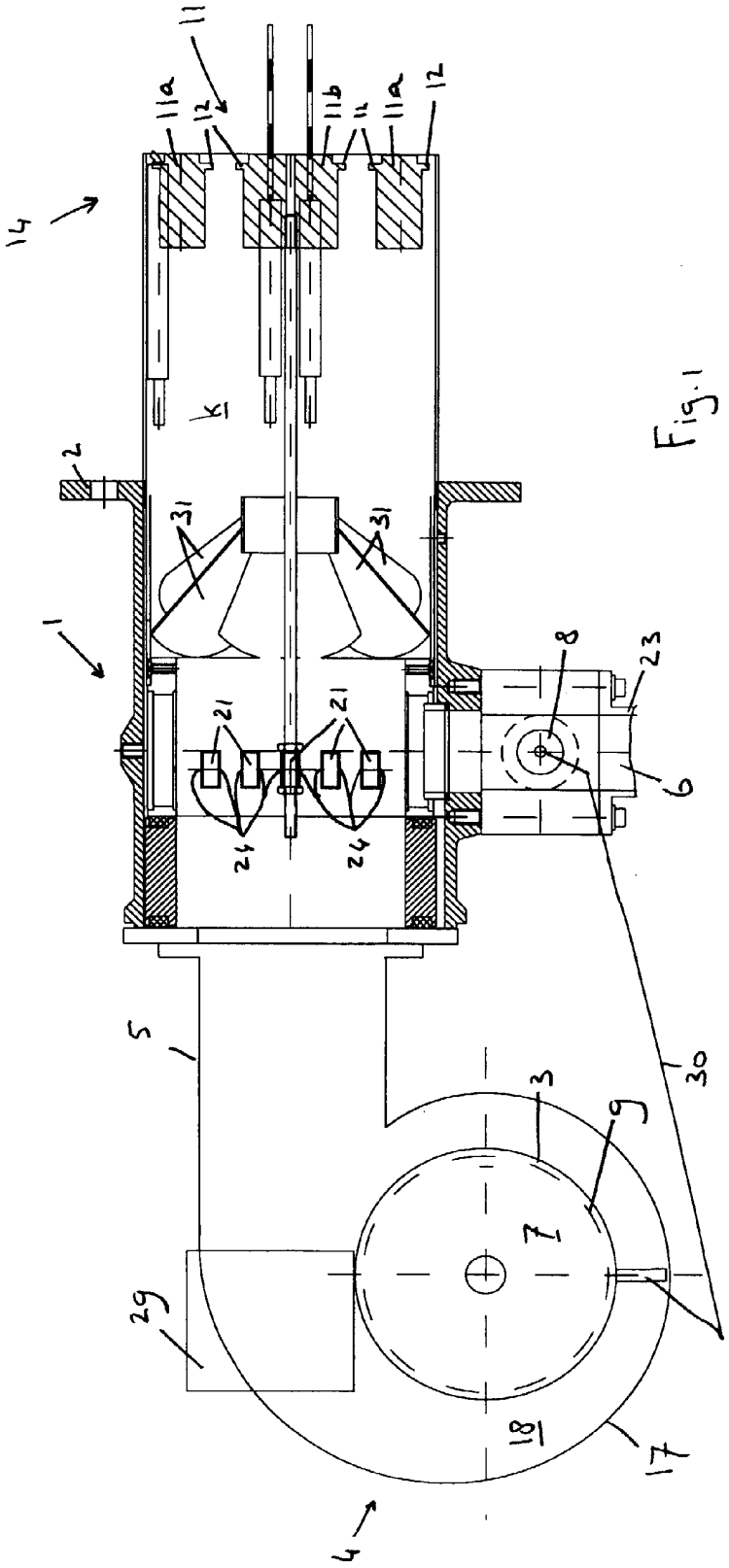

Fig.1

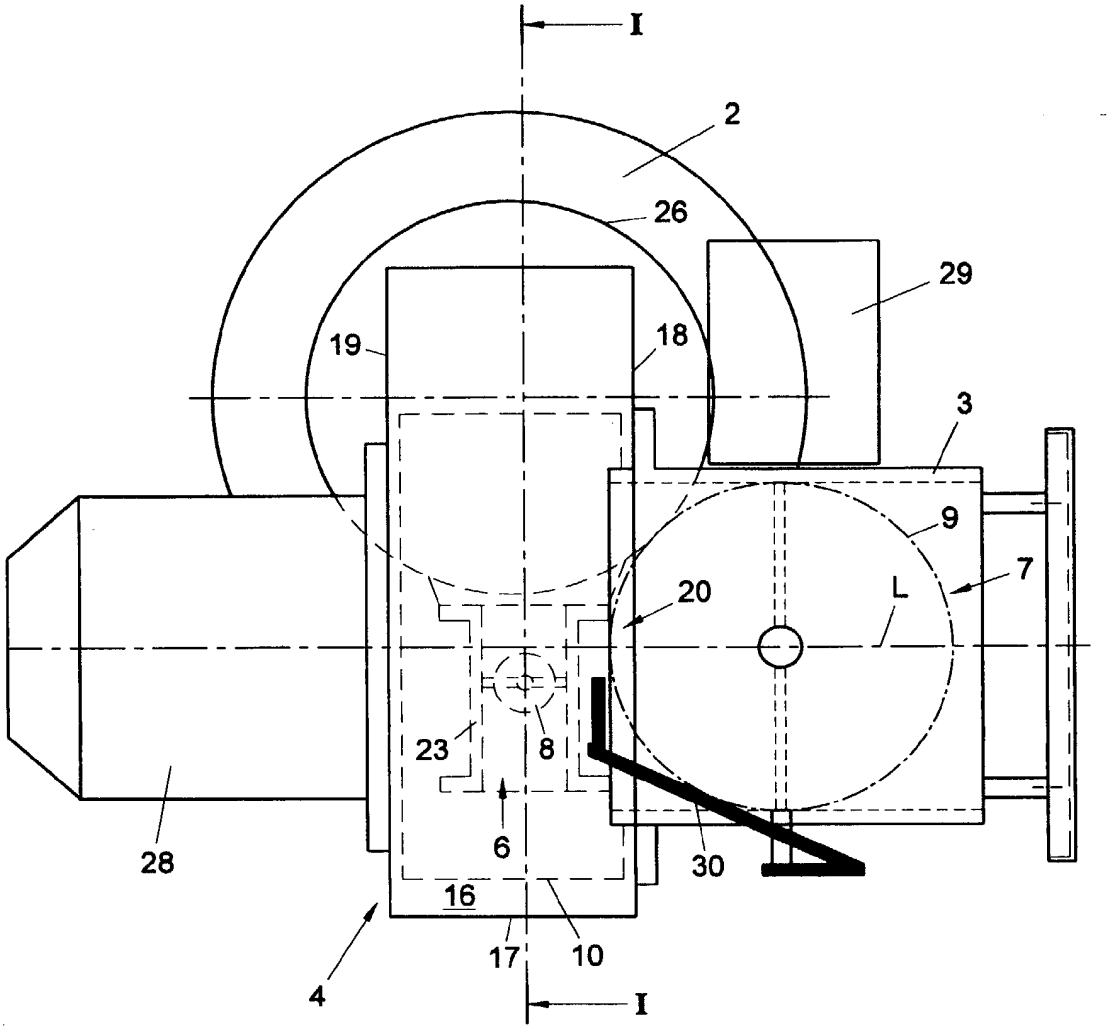

Fig. 2

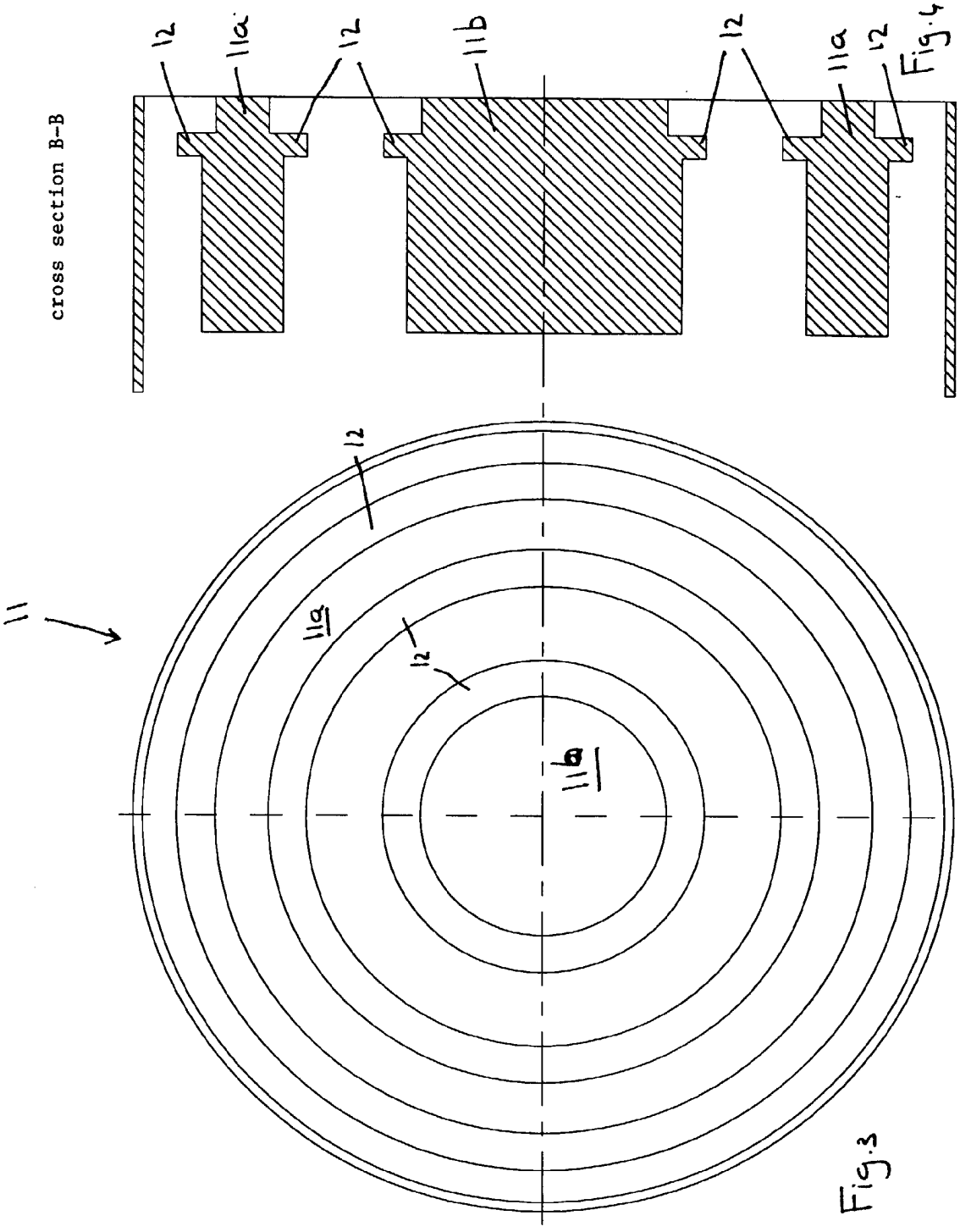

Fig.4

Fig.3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 99 20 1089

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	28 April 2000	Coli, E

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
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T : theory or principle underlying the invention
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D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

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EUROPEAN SEARCH REPORT

Application Number
EP 99 20 1089

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	28 April 2000	Coli, E

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X : particularly relevant if taken alone
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D : document cited in the application
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 99 20 1089

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PUB-NO: EP001026445A1
DOCUMENT-IDENTIFIER: EP 1026445 A1
TITLE: Gas burner
PUBN-DATE: August 9, 2000

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APPL-NO: EP99201089
APPL-DATE: April 6, 1999

PRIORITY-DATA: EP99201089A (April 6, 1999) , EP99200363A (February 8, 1999)

INT-CL (IPC): F23D014/36 , F23D014/02 , F23D014/62 , F23D014/74 , F23D014/58

EUR-CL (EPC): F23D014/02 , F23D014/36 , F23D014/58 , F23D014/62 , F23D014/74

ABSTRACT:

CHG DATE=20000901 STATUS=O> A gas burner comprising a burner housing (1) having a mounting flange (2) by means of which the gas burner

can be mounted on a heating boiler, the burner housing defining at least a part of a channel (K), into which channel a gas supply (6) and a combustion air supply (7) open, the gas burner further comprising a gas supply control valve (8) and a fan (10) for the forced supply of combustion air to the channel, the gas burner further comprising a burner head mounted in/on a downstream end (14) of the channel, said burner head (11) comprising a burner plate (11b) arranged concentrically relative to the longitudinal center line of the channel and at least one burner ring arranged concentrically relative to the burner plate. □